# Routine use of Hemospray for gastrointestinal bleeding: prospective two-center experience in Switzerland

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Abstract: Hemospray (Cook Medical, Winston-Salem, North Carolina, USA) is a hemostatic agent recently introduced for the management of upper gastrointestinal bleeding (GIB). To date, there is little experience with this fairly new hemostatic tool. The aim of this case series was to reflect the use and effectiveness of Hemospray as a treatment option in GIB in everyday clinical practice at two tertiary referral centers. Consecutive patients (n = 16) with active GIB of various origins were treated with Hemospray. The rate of successful initial hemostasis was 93.75 % (15 /16; salvage therapy 92.85 % [13/14]; monotherapy 100 % [2 /2]). The rebleeding rate within 7 days was 12.5 % (2/16). One patient, in whom interventional radiology also failed, had to undergo surgery as salvage therapy. The effectiveness of Hemospray in the management of GIB in various clinical situations is promising. Future multicenter randomized prospective trials for clearly defined bleeding situations are needed for greater generalizability of case series findings.

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**Title page**
**Use of Hemospray in daily routine for GI bleeding: Prospective two-center experience in Switzerland**

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**Abstract:**

Hemospray (Cook Medical, Winston-Salem, North Carolina, USA) is a hemostatic agent recently introduced for the management of upper gastrointestinal bleeding (GIB). To date, small experience exists with this fairly new hemostatic tool. The aim of this case series was to reflect the use and effectiveness of Hemospray as treatment option in GIB in all-day clinical practise. Sixteen consecutive patients with active GIB of various origins were treated with Hemospray. The rate of successful initial hemostasis was 93.75% (as salvage therapy success rate 92.85%; as monotherapy success rate 100%). The rebleeding rate within 7 days was 12.5%. Only one patient failed also interventional radiology and had to undergo surgery as salvage therapy.

Effectiveness of Hemospray in the management of GIB in various clinical situations is promising. Future multicenter randomized prospective trials for clearly defined bleeding situations are needed to increase the generalizability of case series.

## Introduction

Hemospray (Cook Medical, Winston-Salem, North Carolina, USA) is a hemostatic inorganic agent. When in contact with moisture, Hemospray becomes coherent and adhesive, creating a mechanical barrier and effecting hemostasis. Hemospray was recently introduced for the management of upper gastrointestinal bleeding (GIB) [1]. In Europe, Hemospray is not licensed for use in the lower gastrointestinal (GI) tract and therefore currently in off-label use in the lower GI tract. So far, preliminary experience in benign and malignant upper and lower GIB is promising although limited [1-5]. However, optimal indications and technical limitations are still being characterized. We present our prospective case series from daily routine regarding Hemospray in the treatment of GIB in two tertiary endoscopy centres of Switzerland, adding to the increasing experience with this promising treatment modality.

## Case series

*Methods:* From August 2013 until November 2013, consecutive patients with active bleedings of various origins in the upper and lower GI tract were treated with Hemospray in two tertiary endoscopy centres of Switzerland. Data on sex, age, medication, details of procedure, and outcome were collected prospectively. Approval

to use pseudonymised patient data was obtained by the local Ethical committee. Endoscopic hemostatic interventions (using an Olympus 1TQ–scope; Olympus, Tokyo, Japan) were performed exclusively by eleven experienced staff endoscopists (eight endoscopists in St. Gallen, three endoscopists in Zurich) who underwent an official theoretical and practical training in Hemospray application organized by the Clinic of gastroenterology and hepatology, University hospital Zurich together with the company Cook. The training had to be passed before the first clinical application of each endoscopist.

Criteria of utilization of Hemospray: Hemospray was used either as monotherapy or as salvage therapy at the discretion of the performing endoscopist. Following conditions were ideal to prefer Hemospray as first-line therapy over standard hemostatic methods: oozing bleeding from a malignant tumour; bleeding situations which involve larger areas of mucosa that are not well amenable to standard, targeted therapies (e.g. portal hypertensive gastropathy, gastric antral vascular ectasia).

Technique of Hemospray application: Hemospray was applied on to the active bleeding site through a 10-Fr catheter (Cook Medical) in short bursts of a $CO_2$-propelled canister until hemostasis was confirmed. A burst on average contains 1-5 g of powder and lasts about one second. A maximum of 20 g (accords four bursts) was applied. The distal end of the catheter was placed 2 to 3 cm apart from the bleeding in order to prevent sticking the catheter in moisture. Video 1 shows the technique of Hemospray application. Successful initial hemostasis was defined when Hemospray application led to hemostasis after three to five minutes of visual inspection. Second look endoscopy was not performed in standardized regime, but only when rebleeding was assumed.

*Results:* In both centers 194 patients presented with upper and lower GIB from August 2013 until November 2013. Of those 194 patients, 16 (8.25%) patients (81.25% males; median age 67 years (range 40-87 years)) with GIB were treated with Hemospray from August 2013 until November 2013. 13/16 (81.25%) patients had significant co-morbidities. 5/16 (31.25%) presented with shock, needing six packages of red cells in average. In all cases, a maximum of 20g (accords four bursts) of Hemospray was used. Details are shown in table 1. There was a variety of bleeding causes (Table 1 and 2). 25% of the patients suffered from ulcer disease. 81.25% of cases were oozing bleedings. Figure 1 illustrates the hemostatic effect of

Hemospray in a patient with oozing bleeding after percutaneous endoscopic gastrostomy tube insertion. Figure 2 and Video 1 show a spurting ulcer bleeding (Forrest Ia) in the duodenum. After failed hemostatic treatment, Hemospray application was successful.

4/16 cases (25%) had preceding hemostatic endoscopic treatment in our centers within two days beforehand and therefore counted as re-bleedings or hemostatic failures for which repeated endoscopy was necessary. The remaining cases had no previous endoscopy. 14/16 (87.5% of cases) were treated with Hemospray as salvage therapy after failed hemostasis with standard methods such as injection, clipping, heater probe or argon plasma coagulation in the same endoscopic session (Table 1 and 2). In this group with Hemospray as salvage therapy, the rate of successful initial hemostasis was 92.85% (13/14) (Table 2). The rate of initial hemostasis with Hemospray as monotherapy was 100% (2/2) (Table 2). The rebleeding rate within 7 days was 12.5%. Both cases had prior oozing bleeding and needed repeated endoscopy within 24 hours (Table 2). One patient failed also interventional radiology and had to undergo surgery as salvage therapy (Table 1). Neither deaths occurred within 7 days after Hemospray application, nor was a $CO_2$-associated barotrauma noticed.

## Discussion

In this patient series, the outcomes are presented for 16 consecutive patients with active upper and lower GIB who were treated with Hemospray in two high-volume tertiary centers in Switzerland. Our patient collective represents a typical distribution of bleeding causes in the daily routine of gastroenterologists who are on call for emergencies [7]. In expert hands, Hemospray is very effective in reaching initial hemostasis. Our series emphasizes the possible field of application of Hemospray in upper and lower GIB in all-day clinical practise. High efficacy in achieving initial hemostasis of non-variceal upper GIB through Hemospray is also shown by some case reports and small case series [1,2]. So far, only one small clinical prospective study was published that analysed the hemostatic effectiveness of Hemospray in actively bleeding ulcers (20 patients) [1]. Rebleeding appeared in 11% of 19 patients with oozing bleeding. Very recently, the first European prospective non-randomized multicentre SEAL survey (Survey to Evaluate the Application of Hemospray in the Luminal tract) with 63 patients was published as electronic version ahead of print [5].

In this survey, non-variceal upper GIB were analysed. The majority of patients (87%) were treated with Hemospray as monotherapy with a primary hemostasis rate of 85% and a rebleeding rate at 7 days of 15% [5]. 13% of patients were treated with Hemospray as salvage therapy with a hemostasis rate of 100% [5]. In our case series, exept in two cases, Hemospray was used as a salvage modality missing immediate success of conventional hemostatic methods. In this particular setting this new tool in the endoscopist's armamentarium fulfills its purpose. Whether Hemospray may be an ideal first choice hemostatic tool and in which patients needs to be defined.

In Europe, Hemospray is not licensed for use in the lower GI tract and is therefore currently in off-label use in the lower GI tract. The feasibility of Hemospray for colon application was demonstrated recently by Soulellis et al. [3] (case series with 5 patients) and Holster et al. [7] (case series with 9 patients). The preliminary experience from literature shows that Hemospray is a highly effective endoscopic hemostatic alternative in lower GIB [3,7]. In our series, one patient had bled from the lower GI tract, caused by a relapsing anal carcinoma. Hemospray was applied in addition to a surgical suture. So far no other reports in literature have mentioned this indication for Hemospray.

Only preliminary data based on case reports exist regarding the *off-label* use of Hemospray for variceal bleeding [8,9]. Holster et al. [8] reported the first case of variceal bleeding refractory to standard endoscopic therapy, successfully treated with Hemospray, as a bridge towards transjugular intrahepatic portosystemic shunt procedure. So far, no potential complications (e.g. embolization of the powder) after the use of Hemospray in variceal bleeding is reported in literature. One patient with gastric varices in our series was treated successfully with Hemospray after Histoacryl insertion.

A promising indication seems to be bleeding after sphincterotomy. In one of the two patients in our series hemostasis of a spurting sphincterotomy bleeding was difficult, finally success was achieved after combined use of heater probe, CoagGrasper, epinephrine injection, Hemospray and insertion of a fully covered metal stent. Moosavi et al. [10] published a case with transient obstruction of a post-sphincterotomy biliary orifice after Hemospray application. Technically, Hemospray application for bleeding in and around the papilla Vateri is challenging. Maneuvers with the endoscope in the narrow lumen during ongoing bleeding may bring the

application catheter unintentionally in contact with moisture, which sticks the distal end of the catheter and makes spraying impossible.

Some limitations need to be mentioned. First, our series is limited by the small number of patients and also the diversity of indications for therapy. Second , patients treated in a tertiary endoscopy center are usually not comparable with patients in district hospitals. This means a selectional bias. Third, the decision to apply Hemospray or not was at the discretion of the endoscopist being subjective and not reproducible. Exact criteria when to use or not to use Hemospray as the first line agent, were not defined before starting this study. Anyhow all experienced endoscopists trained in endoscopic hemostasis, never used Hemospray in standard situations as first attempt. In this context it needs to be mentioned that Over-The-Scope-Clip (OTSC, OVESCO, Tübingen, Germany) application is also known as a new endoscopic hemostatic tool. We are still somewhat reluctant to apply OTSC in bleeding situations because it is an implant material that usually stays for indefinite time. In our study many endoscopists performed Hemospray application with a good success rate. Hemospray application can be learned easy and quickly without a long learning curve which is certainly a strength of this new hemostatic tool. Therefore we prefer Hemospray over OTSC. In addition an OTSC could be applied subsequently if Hemospray fails. However, to date there are no data available that compared Hemospray versus OTSC. Fourth, the use of anti-thrombotics in our collective appears relatively low in respect of the included population (mean age 67 years). We speculate that one reason could be that our patients had many co-morbidities (according ASA classification III and IV, 62.5 and 18.75%, respectively). At the time of bleeding, the majority of patients was already hospitalized for (at least some) days, and the treating medical team stopped Aspirin or Clopidogrel beforehand due to the life-threatening bleeding situation. The initially healthy patients (ASA I and II) had no anti-thrombotics.

In conclusion, Hemospray in the management of upper and also lower GIB is promising. Hemospray is a welcome hemostatic modality that can be used either instead of the current treatment modalities, but also as salvage therapy after failure of usual modalities. The non-contact nature of Hemospray makes it desirable in situations involving larger areas of mucosa that would not otherwise be amenable to standard, targeted therapies, particularly on antithrombotic therapy. One can speculate, that a direct use of Hemospray without preceding established methods like

heaterprobe, clips etc. might be cost-effective in particular clinical settings. Future multicenter randomized prospective trials are needed to increase the generalizability of case series.

**Competing interests:** None.

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**Figure legend**

Figure 1a: Oozing bleeding after insertion of a percutaneous endoscopic gastrostomy tube (15 Charriere). Epinephrine and Beriplast was injected but failed hemostasis.
Figure 1b: Successful hemostasis after Hemospray application.

Figure 2a: Spurting ulcer bleeding (Forrest Ia) in the duodenum.
Figure 2b: CoagGrasper did not reach hemostasis. After Hemospray application successful hemostasis.